Cloud Absorption Radiometer (CAR) in INTEX-B/MILAGRO: Instrument Description and Science Goals

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The Cloud Absorption Radiometer (King et al. 1986; car.gsfc.nasa.gov) has been used to acquire BRDF measurements of the ocean, sea ice, snow, tundra, savanna, smoke, vegetation, desert, and clouds between 0.340 and 2.301 μm. These measurements involved flights aboard the University of Washington C-131A and CV-580, and date from observations over the Kuwait oil fire smoke and nearby Saudi Arabian Desert and Persian Gulf in 1991, to the more recent CLAMS experiment over ocean surfaces with sunglint (Gatebe et al. 2005).

Figure 1 shows a typical flight pattern whereby the aircraft, with the CAR in the nose cone, flies a clockwise circular pattern above the surface or cloud repeatedly, drifting with the wind, and scans the underlying surface and much of the transmitted solar radiation from above, and makes radiometric observations about every 1° in azimuth and better than 1° in zenith angle with an instantaneous field-of-view of 1°.

Figure 2 shows selected examples of the bidirectional reflectance observed over selected terrestrial surfaces, including Namibian stratus with a rainbow and glory, the Etosha Pan, Namibia, and savanna vegetation at Skukuza, South Africa (Gatebe et al. 2003), and ocean reflectance with sunglint off the Virginia coast in the western Atlantic (Gatebe et al. 2005).

Onboard the Jetstream-31 aircraft, the CAR will be used to acquire multiangular and multispectral observations suitable for satellite validation strategies. These observations will include:

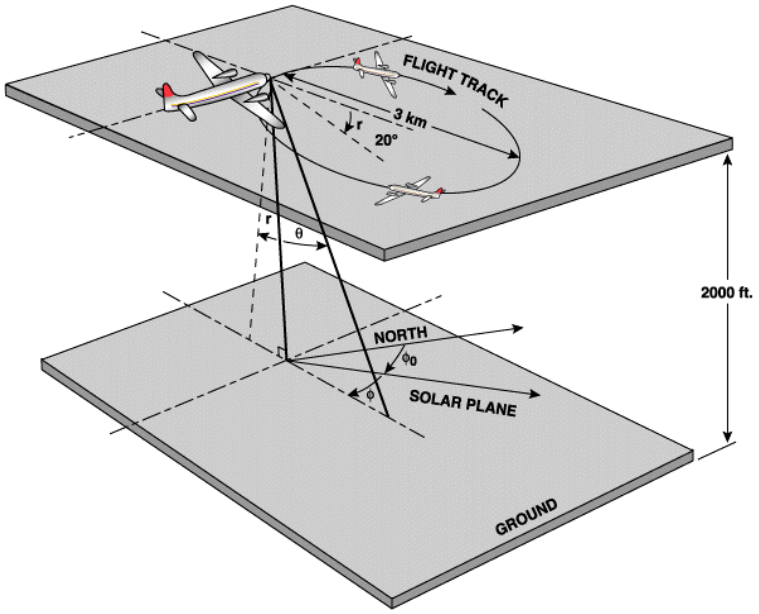

Figure 1. Schematic illustration of a clockwise circular flight track for measuring surface bidirectional reflectance from nadir to the horizon as we as much of the transmittance pattern from near zenith to the horizon (adapted from King 1992).

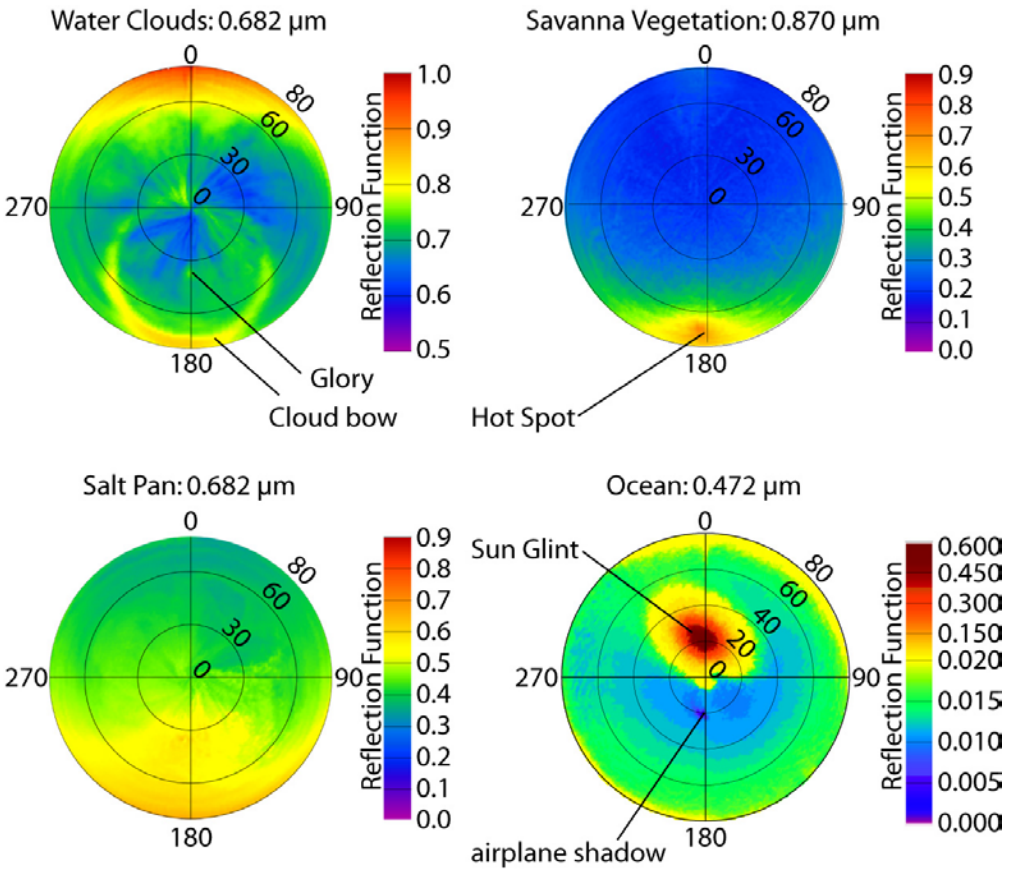

Figure 2. Bidirectional reflectance of various natural surfaces observed by the CAR mounted on the University of Washington CV-580 research aircraft. These observations have all been atmospherically corrected. These observations have all been atmospherically corrected, and include Namibian stratus clouds and the Etosha salt pans of Africa, savanna vegetation in South Africa, and ocean reflectance with sunglint over the western Atlantic Ocean off Virginia, U.S.

- Measurements of spectral bidirectional reflectance distribution functions of a variety of surfaces (e.g., urban center, ocean, cloud, uniformly vegetation soil) at different sun angles and altitudes.
- Retrieve BRDF and aerosol properties by combining CAR with AERONET, AATS, and RSP.
- Validate satellites and intercompare with in-situ measurements (size distribution, single scattering albedo, etc.).

References

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